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EXAMINER

DIAMOND, ALAN D

ART UNIT PAPER NUMBER

1753

DATE MAILED: 01/23/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/723,456

Applicant(s)

SHARPS ET AL.

Examiner

Alan Diamond

Art Unit

1753

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 07 November 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 48-98 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 48-98 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 04 October 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

***Comments***

1. The 35 USC 112, first paragraph, rejections of the claims with respect to the terms “integral to a portion” and “identical sequences of layers” have been overcome by Applicant’s removal of these terms from the claims.
2. The art rejections of the instant claims 48-64 over JP 9-64397 (JP ‘397) have been overcome by Applicant’s amendment of independent claims 48, 52, 57, and 60. In particular, independent claims 48, 52, and 57 now require that there are no solar cells between the bottom (first) solar cell and the lower surface of the substrate, and each layer in the means for passing current (bypass diode) has substantially the same thickness and composition as the corresponding layer in the bottom (first) solar cell. Furthermore, independent claim 60 now requires that the means for passing current and the first solar cell have an identical sequence of layers, and that each layer in the means for passing current has substantially the same composition and thickness as the corresponding layer in the first solar cell.
3. The art rejections of the instant claims 48-59 over Ho et al (WO 99/62125) have been overcome by Applicant’s amendment of independent claims 48, 52, and 57. In particular, independent claims 48, 52, and 57 now require that there are no solar cells between the bottom (first) solar cell and the lower surface of the substrate, and each layer in the means for passing current (bypass diode) has substantially the same thickness and composition as the corresponding layer in the bottom (first) solar cell.

***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

Art Unit: 1753

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 48-98 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In claim 48, at line 9, the “substantially the same composition and thickness” limitation is not supported by the specification, as originally filed. The same applies to dependent claims 49-51.

In claim 52, at line 8, the “substantially the same composition and thickness” limitation is not supported by the specification, as originally filed. The same applies to dependent claims 53-56.

In claim 57, at line 7, the “substantially the same composition and thickness” limitation is not supported by the specification, as originally filed. The same applies to dependent claims 58 and 59.

In claim 60, at line 12, the “substantially the same composition and thickness” limitation is not supported by the specification, as originally filed. The same applies to dependent claims 61-64.

In claim 65, at line 10, the “substantially the same composition and thickness” limitation is not supported by the specification, as originally filed. The same applies to dependent claims 66 and 67.

In claim 67, at line 2, the range “at least one cell” for a cell made from GaAs is not supported by the specification, as originally filed

In claim 67, at line 2, the range “as least in part” for the GaAs fabrication is not supported by the specification, as originally filed.

In claim 68, at line 8, the “substantially the same composition and thickness” limitation is not supported by the specification, as originally filed. The same applies to dependent claims 69-76.

In claim 77, at line 9, the “substantially the same composition and thickness” limitation is not supported by the specification, as originally filed. The same applies to dependent claims 78-87.

In claim 88, at line 9, the “substantially the same composition and thickness” limitation is not supported by the specification, as originally filed. The same applies to dependent claims 89-92.

In claim 93, at lines 8-9, the “substantially the same composition and thickness” limitation is not supported by the specification, as originally filed. The same applies to dependent claims 94-98.

Applicant cites instant Figures 3-5 and the text describing the figures (from page 5, line 27 to page 8, line 4 of the instant specification) for support of the term “substantially the same thickness”. Applicant argues that a single semiconductor structure is etched so that the remaining layers after etching in one region form a bypass diode, and the remaining layers in the other region after etching form a multijunction solar cell, both regions being in a single semiconductor junction. Applicant

Art Unit: 1753

argues that “[t]herefore, inherent as a result of the manufacturing process is the fact that the layers of the bypass device have substantially the same composition and thickness because the bypass device and the subcell were formed from the same layers before etching, and the thickness of the remaining layers is not changed by the etching.”

However, this argument is not deemed to be persuasive because while it can be deduced from the instant figures and specification that the bypass device and subcell integral thereto have the same thickness and composition (see Figures 1 and 5), the term “substantially” opens up to interpretation the same composition and thickness. Such an interpretation is never discussed or addressed in the originally filed disclosure. Inherent in the instant manufacturing process is the fact that the layers of the bypass device have the same composition and thickness as the subcell since the bypass device and the subcell were formed from the sequence of layers of semiconductor structure before etching and the composition and thickness of the remaining layers is not changed by the etching.

With respect to the term “at least one cell” in claim 67, Applicant argues that Figure 1 shows support because at least one of the cells shown in Figure 1 is fabricated from GaAs. However, this argument is not deemed to be persuasive because the fabrication of one cell using GaAs is not sufficient support for the range “at least one cell”. Said range has practically a limitless number of cells as an upper limit. The disclosure of one cell is not sufficient support for a limitless number of cells.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Art Unit: 1753

7. Claims 48-98 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 48, at line 8, the term "layers where each" should be changed to "layers; and wherein each" so as to clearly point out what is intended. The same applies to dependent claims 49-51.

In claim 48, at line 9, it is not clear what is to be encompassed by the term "substantially the same composition and thickness". The same applies to dependent claims 49-51.

In claim 52, at line 7, the term "layers where each" should be changed to "layers; and wherein each" so as to clearly point out what is intended. The same applies to dependent claims 53-56.

In claim 52, at line 8, it is not clear what is to be encompassed by the term "substantially the same composition and thickness". The same applies to dependent claims 53-56.

Claim 57 is now indefinite because it is not clear what is meant by the term "a bypass diode and directly ..." at line 3. The same applies to dependent claims 58 and 59.

In claim 57, at line 7, it is not clear what is to be encompassed by the term "substantially the same composition and thickness". The same applies to dependent claims 58 and 59.

In claim 57, at line 9, the term “cell where there” should be changed to “cell; and wherein there” so as to clearly point out what is intended. The same applies to dependent claims 49-51.

In claim 60, at line 11, the term “layers where each” should be changed to “layers; and wherein each” so as to clearly point out what is intended. The same applies to dependent claims 61-64.

In claim 60, at line 12, it is not clear what is to be encompassed by the term “substantially the same composition and thickness”. The same applies to dependent claims 61-64.

In claim 65, at line 9, the term “layers where each” should be changed to “layers; and wherein each” so as to clearly point out what is intended. The same applies to dependent claims 66 and 67.

In claim 65, at line 10, it is not clear what is to be encompassed by the term “substantially the same composition and thickness”. The same applies to dependent claims 66 and 67.

In claim 68, at line 7, the term “layers where each” should be changed to “layers; and wherein each” so as to clearly point out what is intended. The same applies to dependent claims 69-76.

In claim 68, at line 8, it is not clear what is to be encompassed by the term “substantially the same composition and thickness”. The same applies to dependent claims 69-76.



In claim 77, at line 8, the term "layers where each" should be changed to "layers; and wherein each" so as to clearly point out what is intended. The same applies to dependent claims 78-87.

In claim 77, at line 9, it is not clear what is to be encompassed by the term "substantially the same composition and thickness". The same applies to dependent claims 78-87.

In claim 88, at line 8, the term "layers wherein each" should be changed to "layers; and wherein each" so as to clearly point out what is intended. The same applies to dependent claims 89-92

In claim 88, at line 9, it is not clear what is to be encompassed by the term "substantially the same composition and thickness". The same applies to dependent claims 89-92.

In claim 93, at lines 7-8, the term "layers where each" should be changed to "layers; and wherein each" so as to clearly point out what is intended. The same applies to dependent claims 94-98.

In claim 93, at lines 8-9, it is not clear what is to be encompassed by the term "substantially the same composition and thickness". The same applies to dependent claims 94-98.

With respect to the term "substantially the same thickness" being indefinite under 35 USC 112, second paragraph, applicant cites the same arguments used above with respect to this term and 35 USC 112, first paragraph. However, these arguments are not deemed to be persuasive because it is not clear how close to having the same

thickness the corresponding layers must have in order to be considered to have "substantially the same thickness".

***Claim Rejections - 35 USC § 102***

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. Claims 65, 66, 68-70, 72, 73, 75-78, 80, 84, 86-90, and 92-98 are rejected under 35 U.S.C. 102(b) as being anticipated by JP 9-64397, herein referred to as JP '397.

As seen in Figure 2, JP '397 teaches a solar cell module comprising a multijunction solar cell (201) including first (204A,205A,206A) and second (204B,205B,206B) subcells on a substrate (203); and bypass diode (202) that is integral to the first solar cell by way of common layer (205A), wherein said bypass diode reads on the instant means integral to a portion of the first solar cell for passing current when the multijunction solar cell is shaded (see also paragraphs 0031, 0036, and 0041-0043). As seen in Figure 2, the multijunction solar cell (201) is formed on a first portion of the substrate (203) and the bypass diode (202) is formed next to the multijunction solar cell (201) on a second portion of the substrate (203). The diode (202) and the multijunction solar cell (201) share layers (205A) and (204B) that are epitaxially grown in the same process (see paragraph 0042). As seen in Figure 2, the diode (202) is connected across the first and second solar cells to protect the cells from reverse biasing (see also paragraph 0036). The diode (202) can have a Schottky contact (see paragraph 0055).

Art Unit: 1753

The substrate (203) can be glass coated with a metal or ITO coating (see paragraph 0066), and said metal or ITO coating then reads on the instant lateral conduction layer. With respect to the instant limitation that the instant first region and second region have an identical sequence of layers with substantially the same composition and thickness, it is seen that JP '397's multijunction solar cell solar cell in Figure 1 has transparent electrode (107) followed by collection electrode (108) in a first region. This is the same sequence as in the second region, which has transparent electrode (107D) followed by collection electrode (108D). JP '397's multijunction solar cell and bypass diode form an integral semiconductor body on the substrate (103). Since JP '397 teaches the limitations of the instant claims, the reference is deemed to be anticipatory.

10. Claims 48-66, 68-70, 72, 73-78, 80, 84-90, and 92-98 are rejected under 35 U.S.C. 102(b) as being anticipated by Taylor, GB 2346010 A. See Figures 1c and 1d and pages 5-6 of Taylor, which set forth the features of the instant solar cell semiconductor device. Said Figures 1c and 1d of Taylor clearly show the first subcell (5) and the protection diode (11) have the same sequence of layers with the same thickness. Since Taylor teaches the limitations of the instant claims, the reference is deemed to be anticipatory.

11. Claims 65-92 are rejected under 35 U.S.C. 102(b) as being anticipated by Ho et al, WO 99/62125. See Figure 14B which has the instant multijunction solar cell with Ge substrate, and GaAs (1412,1414,1416) and GaInP (1422,1424,1426) solar cells, and integral bypass diode (1410) that is integral with a portion of the GaAs solar cell and laterally spaced therefrom. The GaAs solar cell and integral bypass diode have the

same sequence of layers with the same thickness. Since Ho et al teaches the limitations of the instant claims, the reference is deemed to be anticipatory.

***Claim Rejections - 35 USC § 103***

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

13. Claims 48-98 are rejected under 35 U.S.C. 103(a) as being unpatentable over Taylor, GB 2346010 A, in view of Marvin et al, "Evaluation of multijunction solar cell performance in radiation environments, Conference Record of the 28<sup>th</sup> Photovoltaic Specialists Conference, pages 1102-1105, published 15-22 September 2000, and Lillington et al, U.S. Patent 5,853,497.

See Figures 1c and 1d and pages 5-6 of Taylor, which set forth the features of the instant solar cell semiconductor device. Said Figures 1c and 1d of Taylor clearly show the first subcell (5) and the protection diode (11) have the same sequence of layers with the same thickness. Taylor teaches that its substrate (1) can be GaAs (see page 5, line 4). Taylor does not specifically teach that its substrate (1) can be Ge, and that its solar cell (5) is GaAs and its solar cell (2) is InGaP. Marvin et al teaches the conventional GaInP/GaAs/Ge two junction device wherein the Ge is the substrate (see the entire document). Lillington et al is relied upon for showing what is well-known in the art, i.e., that GaInP/GaAs can be grown on either a GaAs substrate or a Ge substrate (see col. 1, line 65 through col. 2, line 16). It would have been obvious to one

Art Unit: 1753

of ordinary skill in the art at the time the invention was made to have used a Ge substrate in Taylor's multijunction solar cell in place of the GaAs exemplified by Taylor, and to have used GaInP and GaAs for Taylor's solar cells because GaInP/GaAs can be grown on either a GaAs substrate or a Ge substrate as shown by Lillington et al, and because the GaInP/GaAs/Ge two junction device wherein the Ge is the substrate is conventional in the art, as shown by Marvin et al.

14. Claims 60-98 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ho et al, WO 99/62125.

See Figure 14B which has the instant multijunction solar cell with Ge substrate, and GaAs (1412,1414,1416) and GaInP (1422,1424,1426) solar cells, and integral bypass diode (1410) that is integral with a portion of the GaAs solar cell and laterally spaced therefrom. The GaAs solar cell and integral bypass diode have the same sequence of layers with the same thickness. Ho et al's electrical interconnector C-clamp (1442) corresponds to the metal layer in independent claims 60 and 93. When the C-clamp is connected to front metal (1440) it will be a layer on said (1440). Likewise, when the C-clamp is connected to the back metal (1430), it will be a layer on said (1430). Indeed, Ho et al's Figure 11 shows how the C-clamp (1102) provides for a layer on front metal (702) and a layer on back metal (802). Ho et al teaches the limitations of the instant claims other than the difference which is discussed below.

Ho et al does not specifically teach that said electrical interconnector C-clamp is metal. However, in the absence of anything unexpected, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used metal for

Art Unit: 1753

Ho et al's electrical interconnector C-clamp because said C-clamp is electrically conductive. Ho et al's metal C-clamp 1442 is a layer in metal layer in the device since it forms layers on said front metal 1440 and said back metal 1430.

### ***Response to Arguments***

15. Applicant's arguments filed November 7, 2005 have been fully considered but they are not persuasive.

Applicant argues that "in order for a reference to satisfy the requirement of 'an identical sequence of layers,' the reference must disclose an identical sequence of layers (i.e., layers with identical respective composition and thickness) in both the solar cell portion and the bypass diode portion." Applicant argues that:

"[t]he figure in the '397 reference shows a solar cell with layers numbered 107, 106B, 105B, 104B, 106A, 105A, and 104A. The bypass diode in the '397 reference shows layers numbered 108D, 107D, 104D, and 105D. Thus, there is no layer that corresponds to layer 106 in the bypass diode. In addition, the solar cell shows seven different layers, while the bypass diode only shows four different layers. Therefore, the bypass diode and the solar cell of the '397 reference do not have an identical sequence of semiconductor layers."

However, this argument is not deemed to be persuasive because instant independent claims 65, 68, 77, 88, and 93 recite that the "first region" and "second region" have an identical sequence of layers with substantially the same composition and thickness. It is seen that JP '397's multijunction solar cell solar cell in Figure 1 has transparent electrode (107) followed by collection electrode (108) in a first region. This is the same sequence as in the second region, which has transparent electrode (107D) followed by collection electrode (108D).

Applicant argues point to Taylor's Figure 1C and cite page 5, line 13, of Taylor, and argue that layer (7) is not shared. However, this argument is not deemed to be persuasive because in Taylor's Figure 1D, there is no trench etched through layer (7) (see also page 5, lines 20-24). Etching though layer (7) is an optional alternative and need not be done (see Figure 1d; and page 6, lines 1-2). In any event, even with a trench formed at (13) in Figure 1C, there would be electrical connection via the GaAs substrate (1), which is electrically equivalent to layer (7) (see page 5, lines 3-18).

With respect to Ho et al, Applicant's arguments with respect to independent claims 48 and 52 are moot in view of the fact that Ho et al is no longer being used to reject these claims.

Applicant argues that claim 60 recites a "deposited metal layer", and that "[i]t is readily apparent from Figure 14B [of Ho et al] that C-clamp 1442 is not deposited onto the semiconductor structure and actually protrudes from the device 1400." However, this argument is not deemed to be persuasive because when Ho et al's C-clamp (1442) is placed on the semiconductor structure it is deposited on the semiconductor structure. When something is deposited, it is required to have been put, placed, or set down somewhere.

### ***Conclusion***

16. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

Art Unit: 1753

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alan Diamond whose telephone number is 571-272-1338. The examiner can normally be reached on Monday through Friday, 5:30 a.m. to 2:00 p.m. ET.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'Alan Diamond', with a stylized flourish at the end.

Alan Diamond  
Primary Examiner  
Art Unit 1753

Alan Diamond  
January 19, 2006